

# Executive Summary

<http://www.epa.gov/oar/airtrends>

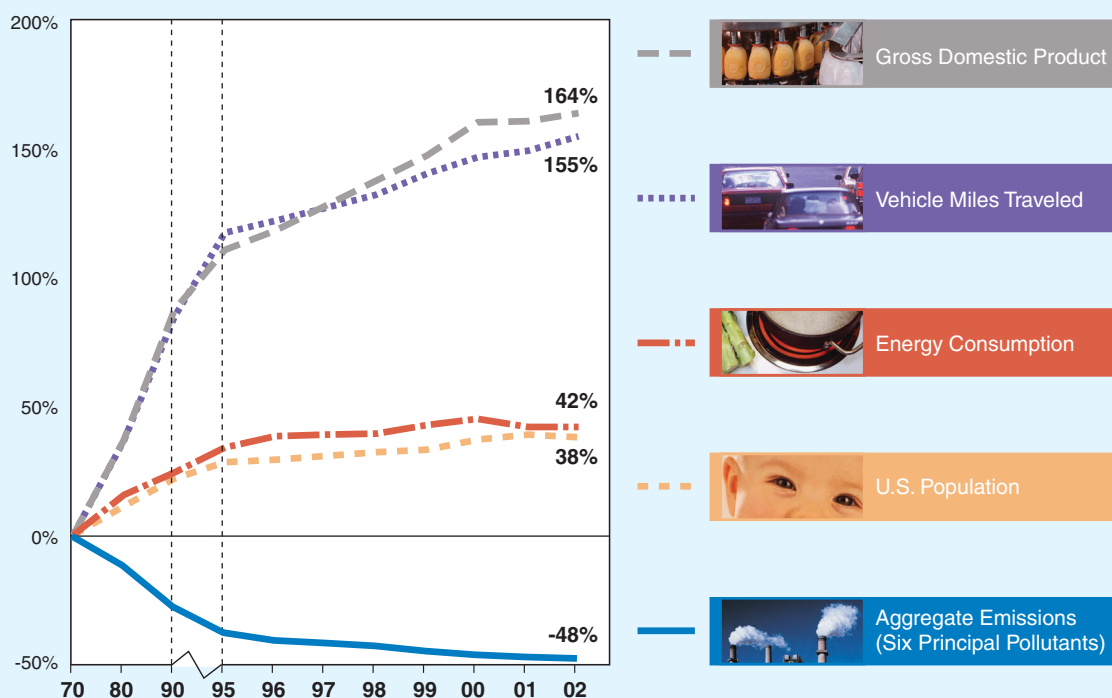
This 28th *National Air Quality and Emission Trends Report* documents air pollution trends in the United States, focusing on the 20-year period from 1983 to 2002 or 1982 to 2001 if that is the most recent data available. This document highlights the U.S. Environmental Protection Agency's (EPA's) most recent thorough assessment of the nation's air quality, and,

for the first time, brings special attention to a series of special studies of policy-relevant air quality issues (see Chapter 6 and the Special Studies section).

In the future, the detailed information traditionally contained in this report will be provided on the Web at <http://www.epa.gov/airtrends> to

facilitate timely updates. A summary of that information will be published each summer as it has for the past several years in EPA's *Latest Findings on National Air Quality: Status and Trends*. This *National Air Quality and Emissions Trends Report* will no longer appear annually in hard copy. Expect future reports to focus on special studies as this report does.

Comparison of Growth Areas and Emissions

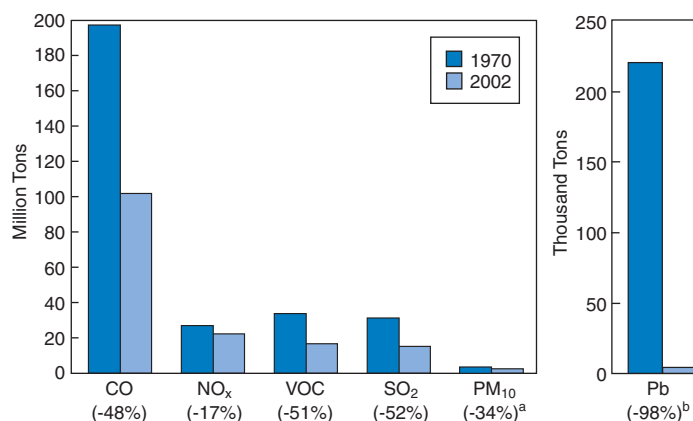


Between 1970 and 2002, gross domestic product increased 164 percent, vehicle miles traveled increased 155 percent, energy consumption increased 42 percent, and U.S. population increased 38 percent. At the same time, total emissions of the six principal air pollutants decreased 48 percent.

## Highlights

- National air quality levels measured at thousands of monitoring stations across the country have shown improvements over the past 20 years for all six principal pollutants.
- Since 1970, aggregate emissions of the six principal pollutants have been cut 48 percent. During that same time, U.S. gross domestic product increased 164 percent, energy consumption increased 42 percent, and vehicle miles traveled increased 155 percent.
- Despite this progress, about 160 million tons of pollution are emitted into the air each year in the United States. Approximately 146 million people live in counties where monitored air in 2002 was unhealthy at times because of high levels of at least one of the six principal air pollutants.
- The vast majority of areas that experienced unhealthy air did so because of one or both of two pollutants—ozone and particulate matter (PM). Important efforts to control these pollutants include implementing more protective National Ambient Air Quality Standards (NAAQS) for ozone and PM and issuing rules to reduce emissions from onroad transportation and stationary combustion sources. These rules will bring reductions in emissions over the next several years.
- Additional reductions will be needed to provide clean air in the future. For example, the Clear Skies legislation currently being considered in Congress would, if enacted, mandate reductions of particle- and ozone-forming compounds from power generators by 70 percent from current levels

Comparison of 1970 and 2002 Emissions



through a nationwide cap and trade program. This will also reduce acid rain and improve visibility. Also, in May 2003, EPA proposed nonroad diesel engine regulations that would help improve PM and ozone air quality. By 2030, this program would reduce annual emissions of PM by 95 percent, nitrogen oxides (NO<sub>x</sub>) by 90 percent, and sulfur levels by 99 percent from these engines.

- Of the six tracked pollutants, progress has been slowest for ground-level ozone. Over the past 20 years, almost all geographic areas experienced some progress in lowering ozone concentrations. The Northeast and Pacific Southwest exhibited the greatest improvement. In particular, substantial progress seen in Los Angeles has continued through 2002. However, the national average ozone (8-hour) levels have been fairly constant in other metropolitan areas. An analysis to adjust 8-hour ozone levels in metropolitan areas to account for the influence of meteorological conditions shows the 10-year trend to be relatively unchanged. At the same time, for many national

parks, the 8-hour ozone levels have increased somewhat.

- Ground-level ozone is not emitted directly into the air, but is formed in the atmosphere by the reaction of volatile organic compounds (VOCs) and NO<sub>x</sub> in the presence of heat and sunlight. Emissions of VOCs have decreased about 40 percent over the past 20 years. However, regional-scale NO<sub>x</sub> reductions over the same period are only 15 percent. More NO<sub>x</sub> reductions will be necessary before more substantial ozone air quality improvements are realized. Some of these additional reductions will result from existing and recently enacted NO<sub>x</sub> emission reduction programs and also, potentially, from the Clear Skies legislation, if enacted.
- The improvement in overall emissions since 1970 included in this year's findings reflect more accurate estimates of VOC, NO<sub>x</sub>, PM, and carbon monoxide (CO) releases from highway vehicles and non-road engines. Previous years' findings underreported emissions for cars and trucks in the 1970s and 1980s. This year's findings incorporate improvements in

EPA's mobile source emission models, which are based on actual emissions measurements from thousands of motor vehicles and have been peer-reviewed. The new mobile model better represents average U.S. driving habits, such as more rapid accelerations and faster highway speeds.

- Sulfates formed primarily from sulfur dioxide (SO<sub>2</sub>) emissions from coal-fired power plants are a major component of fine particles (known as PM<sub>2.5</sub>) in the eastern United States. SO<sub>2</sub> emissions decreased approximately 33 percent from 1983 to 2002. Nationally, average SO<sub>2</sub> ambient concentrations have been cut approximately 54 percent over the same period. Reductions in SO<sub>2</sub> concentrations and emissions since 1990 are primarily due to controls implemented under EPA's Acid Rain Program. Sulfate reductions since 1999 are partly responsible for some improvement in ambient fine particle concentrations, particularly in the southeastern United States.
- In many locations, EPA now has 4 years of air quality monitoring data for PM<sub>2.5</sub>. Areas across the Southeast, Mid-Atlantic, Midwest regions, and California have air quality that is unhealthy due to particle pollution. Region-wide emissions from power plants and motor vehicles are among the largest contributors to the high PM<sub>2.5</sub> concentrations.
- Since 1990, many actions have been taken that will significantly reduce air toxics across the country. Specifically, regulations for facilities such as chemical plants, dry cleaners, coke ovens, and incinerators will reduce emissions of toxic air pollution by 1.5 million

tons from 1990 levels. In addition, recent actions to address emissions of toxic air pollutants from motor vehicles as well as stringent standards for heavy-duty trucks, buses, and diesel fuel will eliminate 95 percent of emissions of diesel particulate matter.

- Measurements have shown that atmospheric concentrations of methyl chloroform are falling, indicating that emissions have been greatly reduced. Concentrations of other ozone-depleting substances in the upper layers of the atmosphere, like chlorofluorocarbons (CFCs), are also beginning to decrease.

## Air Pollution

### *The Concern*

Exposure to air pollution is associated with numerous effects on human health, including respiratory problems, hospitalization for heart or lung diseases, and even premature death. Children are at greater risk because they are generally more active outdoors and their lungs are still developing. The elderly and people with heart or lung diseases are also more sensitive to some types of air pollution.

Air pollution can also significantly affect ecosystems. For example, ground-level ozone has been associated with reductions of agricultural and commercial forest yields, and airborne releases of NO<sub>x</sub> are one of the largest sources of nitrogen pollution in certain waterbodies, such as the Chesapeake Bay.

### *The Causes*

Air pollution comes from many different sources. These include large stationary sources such as factories, power plants, and smelters; smaller sources such as dry cleaners and

degreasing operations; mobile sources such as cars, buses, planes, trucks, and trains; and natural sources such as windblown dust and wildfires.

## Under the Clean Air Act

EPA establishes air quality standards to protect public health, including the health of "sensitive" populations such as children, older adults, and people with asthma. EPA also sets limits to protect public welfare. This includes protecting ecosystems, including plants and animals, from harm, as well as protecting against decreased visibility and damage to crops, vegetation, and buildings.

EPA has set national air quality standards for six principal air pollutants (also called the criteria pollutants): nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), sulfur dioxide, particulate matter, carbon monoxide, and lead (Pb). Four of these pollutants (CO, Pb, NO<sub>2</sub>, and SO<sub>2</sub>) are emitted directly from a variety of sources. Ozone is not directly emitted, but is formed when NO<sub>x</sub> and VOCs react in the presence of sunlight. PM can be directly emitted, or it can be formed when emissions of nitrogen oxides, sulfur oxides, ammonia, organic compounds, and other gases react in the atmosphere.

Each year EPA looks at the levels of these pollutants in the air and the amounts of emissions from various sources to see how both have changed over time and to summarize the current status of air quality.

## Reporting Air Quality and Emissions Trends

Each year, air quality trends are created using measurements from monitors located across the country. The following table shows that the air quality based on concentrations

	Percent Change in Air Quality	
	1983-2002	1993-2002
NO <sub>2</sub>	-21	-11
O <sub>3</sub> 1-h	-22	-2 <sup>a</sup>
8-h	-14	+4 <sup>a</sup>
SO <sub>2</sub>	-54	-39
PM <sub>10</sub>	—	-13
PM <sub>2.5</sub>	—	-8 <sup>b</sup>
CO	-65	-42
Pb	-94	-57

	Percent Change in Emissions	
	1983-2002	1993-2002
NO <sub>x</sub>	-15	-12
VOC	-40	-25
SO <sub>2</sub>	-33	-31
PM <sub>10</sub> <sup>c</sup>	-34 <sup>d</sup>	-22
PM <sub>2.5</sub> <sup>c</sup>	—	-17
CO	-41	-21
Pb <sup>e</sup>	-93	-5

—Trend data not available.

<sup>a</sup> Not statistically significant.

<sup>b</sup> Based on percentage change from 1999.

<sup>c</sup> Includes only directly emitted particles.

<sup>d</sup> Based on percentage change from 1985.

Emission estimates prior to 1985 are uncertain.

<sup>e</sup> Lead emissions are included in the toxic air pollutant emissions inventory and are presented for 1982-2001.

*Negative numbers indicate improvements in air quality or reductions in emissions. Positive numbers show where emissions have increased.*

of the principal pollutants has improved nationally over the past 20 years (1983–2002).

EPA estimates nationwide emissions of ambient air pollutants and the pollutants they are formed from (their precursors). These estimates are based on actual monitored readings or engineering calculations of the amounts and types of pollutants emitted by vehicles, factories, and other sources. Emission estimates are based on many factors, including levels of industrial activity, technological developments, fuel consumption, vehicle miles traveled, and other activities that cause air pollution.

Methods for estimating emissions continue to improve. Today's estimates are different from last year's estimates. One reason is because this year EPA used updated, peer-reviewed models that estimate VOC, NO<sub>x</sub>, CO, and PM emissions from highway vehicles and nonroad engines and better represent real-world conditions, such as more rapid accelerations and faster highway speeds. The emissions estimates generated by the new highway vehicle model are derived from actual tailpipe measurements from thousands of vehicles. Another change in the reporting of emissions trends is that emissions from wildfires and prescribed burnings are not considered in the estimates of emission change. This is due to the large variability in the year-to-year levels of these emissions and the relatively small impact these distant emissions have on most monitoring locations. Because of the high degree of uncertainty in predicting emissions for these fires, their emissions have not been projected for 2002 for PM, CO, and VOCs. These emissions will be estimated when 2002 acres-burned data become available. However, fire emissions are included in the emission graphics through 2001. As a result of these reporting changes, some emissions trends have changed significantly. For example, rather than describing no change in the 20-year emission trend for CO, EPA now estimates a 41 percent decrease in CO emissions from 1983 to 2002. This estimated change in emissions is supported by the trend in CO air quality.

Emissions of air pollutants continue to play an important role in a number of air quality issues. About 160 million tons of pollution are emitted into the atmosphere each year in the United States. These

emissions mostly contribute to the formation of ozone and particles, the deposition of acids, and visibility impairment.

Despite great progress in air quality improvement, approximately 146 million people nationwide lived in counties with pollution levels above the NAAQS in 2002. Out of the 230 nonattainment areas identified during the 1990 Clean Air Act Amendments designation process, 124 areas remain. In these nonattainment areas, however, the severity of air pollution episodes has decreased.

## The Clean Air Act

The Clean Air Act provides the principal framework for national, state, tribal, and local efforts to protect air quality. Improvements in air quality are the result of effective implementation of clean air laws and regulations, as well as efficient industrial technologies. Under the Clean Air Act, EPA has a number of responsibilities, including

- Conducting periodic reviews of the NAAQS for the six principal pollutants that are considered harmful to public health and the environment.
- Ensuring that these air quality standards are met (in cooperation with the state, tribal, and local governments) through national standards and strategies to control air pollutant emissions from vehicles, factories, and other sources.
- Reducing emissions of SO<sub>2</sub> and NO<sub>x</sub> that cause acid rain.
- Reducing air pollutants such as PM, SO<sub>x</sub>, and NO<sub>x</sub>, which can reduce visibility across large regional areas, including many of the nation's most treasured parks and wilderness areas.

- Ensuring that sources of toxic air pollutants that may cause cancer and other adverse human health and environmental effects are well controlled and that the risks to public health and the environment are substantially reduced.
- Limiting the use of chemicals that damage the stratospheric ozone layer in order to prevent increased levels of harmful ultraviolet radiation.

### **Criteria Pollutants — Metropolitan Area Trends**

Out of 263 metropolitan statistical areas, 34 have significant upward trends. Of these, only those trends involving 8-hour ozone had values over the level of the air quality standard.

Of the five criteria pollutants used to calculate the Air Quality Index (AQI), only four (CO, O<sub>3</sub>, PM<sub>10</sub>, and SO<sub>2</sub>) generally contribute to the AQI value. Nitrogen dioxide is rarely the highest pollutant measured. Although five criteria pollutants can contribute to the AQI, the index is usually driven mostly by ozone.

### **Criteria Pollutants — Official Nonattainment Areas**

As of September 2002, there were a total of 124 classified nonattainment areas on the condensed nonattainment list (see Table A-19). The areas on the condensed list are displayed alphabetically by state. There were, as of September 2002, approximately 126 million people living in classified areas designated as nonattainment for at least one of the criteria pollutants.

### **Air Toxics**

EPA has developed a National-Scale Air Toxics Assessment, which is a nationwide analysis of air toxics. The assessment uses computer modeling of the 1996 National Emissions Inventory (NEI) air toxics data as the basis for developing health risk estimates for 33 toxic air pollutants (a subset of the Clean Air Act's list of 188 air toxics plus diesel PM). The highest ranking 20 percent of the counties in terms of risk (622 counties) contain almost three-fourths of the U.S. population. Three air toxics (chromium, benzene, and formaldehyde) appear to pose the greatest nationwide carcinogenic risk. One air toxic, acrolein, is estimated to pose the highest potential nationwide for significant chronic adverse effects other than cancer.

### **Special Studies**

For the first time, a series of policy-relevant studies and exploratory analyses are summarized in this report (see Chapter 6). These studies address analysis of PM concentrations, carbon monoxide trends, the number of days above AQI levels of 100 for the ozone NAAQS, the spatial variation of air pollutants, and a proposed new reporting technique for air quality data. The full reports are also included in this Special Studies edition.

